

## 1                   AXIALLY ACTUATED DRAIN VALVE FOR POOLS AND SPAS

## 2   Specification

3       Field of the Invention

4           An axially actuated drain valve for draining pools and spas  
5       which enables connection with a hose.

6       Background of the Invention

7           Pools and spas of every kind require drainage of their water  
8       so the pool itself can be cleaned and supplied with fresh water.  
9       Every pool and spa incorporates some plumbing for this function.

10          Free standing pools and spas have special requirements that  
11       are not necessary for subgrade installations. Free standing  
12       installations are elevated where their sides are in plain sight.  
13       Conventional hardware in plain sight is neither attractive nor  
14       convenient, and can be run into. Also, especially in home  
15       installations, low cost, low maintenance, and high reliability  
16       are of great importance.

17          Especially in colder regions where freezing is a risk,  
18       although the entire tank of water may not freeze, local regions  
19       such as drain valves may indeed freeze and be damaged.

20          It is an object of this invention to provide a conveniently  
21       installed and conveniently used drain valve that can be molded  
22       from suitable resins which is unobtrusive in contour,  
23       comparatively inexpensive to manufacture, and which when closed  
24       provides no regions where water could be confined which could

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1 create a risk when frozen.

2 It is another object of this invention to provide a drain  
3 valve adapted conveniently to be engaged by a hose coupling for  
4 conveying away the drained water and which valve when closed and  
5 disconnected from the hose is recessed and mostly out of sight.

6 Brief Description of the Invention

7 A valve according to this invention has a central axis of  
8 actuation. It includes a body attachable to an opening in a  
9 vessel wall. It has a central passage with an inlet end which  
10 extends into the vessel, an outlet end facing outwardly from the  
11 vessel, and an internal bore extending from end to end.

12 The body includes a peripheral wall, an inlet port, an  
13 axially extending first peripheral sealing surface in  
14 communication with said inlet port, an axially extending second  
15 peripheral sealing surface in said passage spaced from said first  
16 peripheral sealing surface, and an axially extending relief  
17 located between said peripheral sealing surfaces.

18 A plunger has a central axis and is mounted coaxially in  
19 said passage for axial reciprocable movement therein. The  
20 plunger has an inner end and an outer end. Adjacent to its inner  
21 end the plunger has a first peripheral sliding seal. A second  
22 peripheral sliding seal also surrounds said plunger. Said  
23 sliding seals are adapted to make respective sliding sealing  
24 contacts with said first and second peripheral sealing surfaces

1 in said passage, a central flow bore extending from said outer  
2 end into said plunger, and a side port extending laterally from  
3 the flow bore through said plunger, opening from said flow bore  
4 between said first and second sliding seals, and a hose coupler  
5 adjacent to said outer end.

6 According to a preferred but optional feature of the  
7 invention, the diameter of the inlet port is smaller than the  
8 diameter of the first peripheral sealing surface, and an end seal  
9 is formed on the said inner end to close the inlet port when the  
10 plunger is fully inserted in the passage.

11 The above and other features of this invention will be fully  
12 understood from the following detailed description and the  
13 accompanying drawings, in which:

14 Brief Description of the Drawings

15 Fig. 1 is a side view of a valve according to the invention  
16 installed in the wall of a vessel;

17 Fig. 2 is an axial cross-section of the valve of Fig. 1 in  
18 its open condition, taken at line 2-2 in Fig. 1;

19 Fig. 3 is an axial cross-section of a portion of the valve  
20 of Fig. 1;

21 Fig. 4 is a side view of the plunger shown in Fig. 2; and

22 Figs. 5, 6 and 7 are lateral cross-sections taken at lines  
23 5-5, 6-6, and 7-7, respectively in Fig. 4.

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1 Detailed Description of the Invention

2 A drain valve 20 according to this invention is shown  
3 installed in the wall 21 of a vessel 22. The term "vessel" as  
4 used herein is intended to include all such pools, spas, tanks,  
5 and ponds of the sort that are used for recreation purposes, and  
6 also to such structures as may be used for aquariums. The common  
7 feature of these applications is the need to remove and replace  
8 the water in them, and to clean its structure while empty. The  
9 most pertinent installations will be above grade, where any  
10 related plumbing will be visible.

11 Valve 20 includes a body 25 with an outer wall 26 that  
12 carries a thread 27 which receives a pair of collars 28, 29.  
13 These collars, when threaded onto the body will hold the body to  
14 the vessel wall. It is a desirable feature of the invention that  
15 the valve, when closed, need not project beyond the vessel wall.  
16 This product when installed is unobtrusive.

17 Valve body 25 has a central passage 30 which extends from  
18 its inner end 31 to its outer end 32. The passage has an  
19 internal peripheral wall. At its inner end it closes down to an  
20 inlet port 34. Inlet port 34 is bounded by a seat 35.

21 Passage 30 has a central axis 36. Adjacent to its inner  
22 end, the passage includes a first peripheral sealing surface 37.  
23 A second peripheral sealing surface 38 is spaced from the first  
24 peripheral sealing surface 37 by axially- extending peripheral

1 recesses 39. These sealing surfaces are cylindrical and coaxial.

2 The reduced-dimension inlet port 34 is optional. If desired  
3 it can be eliminated, and the first peripheral sealing surface  
4 will define, at its inner end, the entry port to the valve.

5 First peripheral sealing surface 37 has a dimension of axial  
6 length 38, which will be discussed in further detail below.  
7 Similarly second peripheral sealing surface will have an axial  
8 length 40.

9 For molding convenience, the inlet port 34 and first  
10 peripheral sealing surface 37 are formed on a separate insert 44  
11 that is pressed into the body.

12 It will be observed that the inside diameter of the first  
13 sealing surface 37 is the same as the diameter of the second  
14 peripheral sealing surface 38. There is a minor gap 45 of no  
15 significance between them.

16 Again for molding convenience, body 25 provides recesses 39  
17 between axially-extending vanes 46. These recesses terminate  
18 between the two sealing surfaces.

19 A plunger 50 has a central axis 51. It is mounted coaxially  
20 in the body passage for axial reciprocation. When fully inserted  
21 to the right in Fig. 2, it will close the valve. In Fig. 2 the  
22 valve is shown in its fully open configuration. When  
23 sufficiently extended, the plunger will open the valve to drain  
24 the vessel. When closed, there will remain no region in the

1 valve in which water would be confined so as to be locally  
2 frozen.

3 The plunger has an inner end 52 and an outer end 53. Its  
4 wall 54 carries a thread 55 which forms part of a hose coupling  
5 (not shown). It can also receive an internally threaded closure  
6 cap 56 if desired.

7 The plunger includes a flow bore 60 which extends into the  
8 plunger from its outer end toward its inner end, at which it is  
9 closed. A flow port 61 extends from the flow bore through the  
10 wall of the plunger to its outside surface.

11 When the reduced-dimension inlet port 34 is provided, the  
12 plunger will carry an inlet port closure 65. Preferably the  
13 closure will carry a sealing ring (not shown), but may instead be  
14 a simple tapered or rounded plug to close the inlet port when the  
15 plunger is fully inserted.

16 A first peripheral seal 65 is formed around the plunger near  
17 its inner end. Preferably it includes a pair of ring seals 66,  
18 67 which make a sliding fluid sealing fit in the first peripheral  
19 sealing surface 37. Here it will be observed that, so long as  
20 seal 65 remains in sealing surface 37, the valve will be closed.  
21 When the reduced area inlet port is used, it will provide a  
22 secondary seal against leakage. If it is not provided, then  
23 surface 37 and seal 65 act as an inlet port.

24 Notice particularly that the plunger can move from fully

1 closed to fully open by axially moving past sealing surface 37, a  
2 distance equal to dimension 38. This is an important function,  
3 because it enables the plunger to be pulled out by a useful  
4 distance without opening the valve. This exposes thread 55 so  
5 that after removing cap 56, a hose coupling can be threaded onto  
6 the plunger while the valve still remains closed.

7 A second peripheral sliding seal 70 is formed on the  
8 plunger, spaced from the first by an axial spacing 71. Sealing  
9 rings 72 slide along and seal with the second peripheral sealing  
10 surface. Flow port 61 opens through the wall of the plunger  
11 between sliding seals 65 and 70. Flow port 61 will always face  
12 into recess 39.

13 It is necessary that the plunger be axially reciprocable so  
14 the valve can be opened and closed. It is desirable, although  
15 not necessary, for the plunger to be restrained against excessive  
16 rotation so a hose coupling can more readily be threaded onto it.  
17 If not so provided, the valve will still function and can be  
18 coupled, but then the user would have to hold the plunger against  
19 rotation, which he could do.

20 To facilitate this function, two sets of splines 75, 76 (six  
21 apiece) are formed, with the sets angularly disposed relative to  
22 one another. Their function is to react with a notched stop 77  
23 with an equal number of equally spaced notches 78. This stop  
24 extends into the passage, and will stop the plunger from moving

1 excessively toward the outer end of the passage unless the  
2 splines pass through a notch. Also it will always block sliding  
3 seal 70 to prevent the expulsion of the plunger from the outside  
4 end. Accordingly, the valve must be assembled from its inner  
5 end.

6 When the plunger is in its outer position, splines 75 will  
7 be engaged in the notches, and splines 76 are angularly placed so  
8 they will engage the stop. The plunger will be restrained  
9 against rotation. Instead of the illustrated cap (which will  
10 close the valve in all plunger positions, a hose coupling (not  
11 shown) may be threaded on to the plunger instead.

12 It will be observed that the body forms a receptacle cavity  
13 80 which will receive the cap when the valve is closed, so that  
14 it will not protrude beyond the vessel wall.

15 The operation of this drain valve will be evident from the  
16 foregoing. With the plunger fully inserted, the valve is closed,  
17 and the threads remain inside body cavity 80. In order to attach  
18 a hose, the plunger is pulled partway out, so that the first  
19 sliding seal remains engaged to the first peripheral sealing  
20 surface.

21 Then the valve will be opened by pulling the plunger farther  
22 out. At this time the first sliding seal clears the first  
23 sealing surface, so that the inlet port is open and water can  
24 flow into recesses 39, and from the recesses into the flow port



1 and out the flow bore.

2 At this time the second sliding seal will have engaged the  
3 second sealing surface to prevent leakage pass the plunger. The  
4 outward movement of the plunger will be stopped when the stop  
5 surface 41 is engaged by the plunger.

6 Closure of the valve will be accomplished by moving the  
7 plunger into the body. When the first sliding seal again engages  
8 the first sealing surface, the hose can be disconnected, and the  
9 plunger then shoved all the way in. The hydraulic pressure  
10 involved is so small that the friction forces in the valve will  
11 suffice to hold the valve closed, especially when the smaller  
12 inlet port is used. However, with a cap on the plunger, the  
13 valve will not leak even if the plunger is fully out.

14 It will be observed that the regions on the outside of the  
15 plunger vented to atmospheric are fully drained. Similarly, with  
16 the valve closed and before the cap is applied, the inside of the  
17 plunger will be fully drained. There is no "loose" water to be  
18 frozen.

19 This valve is readily produced by injection molding  
20 processes, and requires only the application of ring seals for  
21 completion. It is inexpensive, unobtrusive, and reliable.

22 This invention is not to be limited by the embodiment shown  
23 in the drawings and described in the description, which is given  
24 by way of example and not of limitation, but only in accordance

1 with the scope of the appended claims.